Studying the Effects of Affective Feedback in Embodied Tutors

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Abstract

We present a study designed to explore the effect of feedback on perception of an interactive embodied agent as well as the overall performance and experience of primary school children aged 12-13 carrying out a treasure hunt activity. We use an interactive dialogue agent to compare three experimental conditions: no feedback, neutral feedback, and affective feedback. We study if the agent in the affective condition helps in engagement of the task more than the two other conditions.

1 Introduction

Emotions play an important role in human-human interaction (Damasio, 1994). Agents that exhibit human-like emotions have now become a commonplace in the domain of human-computer interaction. Starting from the pioneering work of (Bates, 1994) and (Picard, 1997), emotional agents now exists in various applications to serve different purposes including but not limited to military (Gratch and Marsella, 2004), health (Bickmore and Picard, 2005), commerce (Gong, 2007), tourism (Lim, 2007), video games (Isbister, 2006) and education (Okonkwo and Vassileva, 2001; Prendinger et al., 2003; Dias and Paiva, 2005; Maldonado et al., 2005). In education, emotional expressions have been incorporated into embodied teaching agents with the aim of improving learning experience in users. Although inclusion of emotional expressions into virtual tutors rarely lead to negative interaction, positive effect was not always achieved on learning experience (Beale and Creed, 2009).

In this paper, we present an experiment to investigate how feedback—none, neutral, or affective—affects a child's perception, experience and performance in a real-world treasure hunt activity.

This work takes place in the context of the EU project EMOTE[1] (EMbOdied-perceptive Tutors for Empathy-based learning) which aims to develop virtual tutors that have the perceptive and expressive capabilities to engage in empathic interactions with learners in school environments, grounded in psychological theories of emotion in social interaction and pedagogical models for learning facilitation.

2 The Treasure Hunt

2.1 The Experiment

The treasure hunt activity requires a child to apply his/her map reading skills and is aimed at primary school children aged 12-13. There will be three experimental conditions: no feedback, neutral feedback and affective feedback. In the no feedback condition, students will be given paper maps and instructions, and will not interact with an embodied agent at all during the treasure hunt. In the other two conditions, students will be given Android tablets running an application which displays a digital version of the paper map, along with an embodied agent which will present the instructions and pose the questions. This agent will also provide the students with feedback on the correctness of their answers to the questions posed during the treasure hunt; depending on the experimental condition, the feedback will be either neutral or affective.

In total, 36 students will participate in this study. They will carry out the treasure hunt in pairs, resulting in 6 groups per condition. Prior to the treasure hunt, all students will have a short interactive session with a robot called Susie. The robot will introduce the treasure hunt and conduct a short question and answer session to check the students' readiness for the activity. The robot will be controlled by a wizard in the neighbour-

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[1] `http://www.emote-project.eu/`

Figure 1: The Treasure Hunt Application Start Screen

ing room, and will therefore be capable of taking a few questions from the students if necessary. The main aim of this session is to allow the students to interact and familiarise themselves with the robot, which will then appear as an embodied virtual agent on the tablet for the feedback conditions.

Through this treasure hunt activity, we would like to explore the effect of feedback on the students' perception of an embodied agent as well as their overall experience and performance in carrying out the task at hand. In this study we restrict the emotional display to only three basic expressions (neutral, happy and sad) to ensure that the children understand the affective information being communicated.

The feedback includes both emotional facial expressions and utterances. In the affective condition, a happy expression will be displayed accompanied by utterances such as "brilliant, very good, fantastic" when students answer a question correctly, while a sad expression will be displayed accompanied by utterances such as "Oh no, I'm sorry" when they answer incorrectly; in the latter case, the correct answer will also be provided. In the neutral condition, the agent will always display a neutral expression and reply with "correct" or "incorrect" utterances.

2.2 Treasure Hunt Application

We have designed and implemented a treasure hunt Android application for the above study. In order to compare the three experimental conditions, we have kept the features of the application to be as close to the paper version as possible, except for the addition of the embodied character Susie.

Each step starts with the virtual character presenting a task and questions to the user through speech. Subtitles are displayed on screen in case the students missed what Susie was saying, and the students can also replay the speech at any point if necessary. Each task requires the students to walk a few yards making use of their map skills. At the end of each walk, the students have to confirm their arrival.

The system will then re-present relevant questions related to the task with multiple choice answers and the students are required to select an answer from the given choices. Depending on whether the answer is correct or not, the system responds with appropriate feedback: neutral or affective. In the paper version, the students are also presented with multiple choice answers of which they have to circle the correct one.

2.3 Data Collection

Following the treasure hunt, the students will answer a short questionnaire. It focuses specifically on the children's perception of the embodied agent and their overall experience of the treasure hunt activity, applying the combination of Godspeed likeability items (Bartneck et al., 2009) and the Smileyometer, an instrument used to measure enjoyment and fun (Read and Macfarlane, 2002) aiming to make the task of answering the questionnaire more interesting for the target group. The Smileyometer uses pictorial representations of different kinds of happy faces to depict the diverse level of satisfaction according to 5-point Likert scale.

3 Conclusion and Future Work

By the time of this workshop we will have analysed and deduced reasonable answers to our research questions which hopefully will provide insights to our future design of an empathic tutor.

Acknowledgements

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